REMARKS

Accompanying this Preliminary Amendment, please find a substitute specification which overcomes the informalities noted in the original specification. The undersigned avers that the enclosed substitute specification does not contain any new matter.

Newly entered claims 6-11 merely rewrite the subject matter of original claims 1-5 in a more traditional U.S. claim format. The entered amendments are not, in any way, directed at distinguishing the present invention from any known prior art. Please consider the newly entered claims upon consideration of this application.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

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[001] SEAL FOR AN ELECTRIC MACHINE LOCATED WITHIN A DRIVE TRAIN OF A MOTOR VEHICLE

[002] This application is a national stage completion of PCT/EP2004/005330 filed May 18, 2004 which claims priority from German Application Serial No. 103 23 253.2 filed May 23, 2003.

[003] FIELD OF THE INVENTION

[004] The invention relates to a seal for an electric motor installed within a motor vehicle drive mechanism ~~according to the preamble of the claim 1~~.

[005] BACKGROUND OF THE INVENTION

[006] Known already for some time now is a drive system for motor vehicles which, in addition to a conventional combustion engine, also has an electric motor that is integrated into the drive mechanism of the motor vehicle either alternatively or also concurrently. These drive systems, known as "hybrid drives", have many advantages from the ecological point of view, since the mixed type of drive mechanism can also achieve significant savings in energy in mixed driving (city/country) when compared to an exclusively combustion engine drive.

[007] Such hybrid drives for motor vehicles have been disclosed in DE 199 17 665 A1, which has a first electric motor located within the drive mechanism between the combustion engine and the vehicle drive mechanism and a second electric motor permanently linked to a transmission drive shaft. Additionally, a gearshifting clutch is located between the electric motor and the combustion engine operating as a motor and as a generator.

[008] In practice, the axial construction length of the motor vehicle drive mechanism, especially in the front traverse arrangement, plays a significant role. In order to achieve an especially short drive design, it has been shown to be useful to take advantage of the free construction space within the rotor of the electric machine. In this respect, it is know that at least one coupling of the drive system could be used there whereby, preferably a wet-running or, as the case may be, oil-cooled multiple disk clutch can be inserted.

[009] Nevertheless it has shown to be disadvantageous when an annular gap between the rotor and the stator of an electric motor which, as such should remain free of oil, is used with the above noted cooling oil, since the centrifugal force created radially pushes the oil outward through the disks of the multiple disk clutch and is returned in a large diameter back to the crankcase sump. In the studies completed with such diameters, and based on the usual number of revolutions, or because of the high rate of rotation of the motor vehicle's drive mechanism or, as the case may be, its peripheral velocity affecting the seals, these have not been shown to be useful for the annular gap, since they are subjected to a relatively high rate of wear and tear. Here is where the invention described in the following text enters the picture.

[010] The purpose of the invention is to provide a relatively abrasion-free seal for an electric motor that is inserted within the motor vehicle drive mechanism to an electric motor rotor located within the free construction space of the wet-running electric machine rotor, or as the case may be, oil cooled gearshift element, for example, of a multiple disk clutch, with which an annular gap, free of oil to the highest degree possible, between the rotor and the stator of an electric machine is practicable.

[011] According to the invention, this task together ~~with the characteristics of the preamble to Claim 1~~ is solved in that in order to achieve the highest possible level oil-free annular gap between the rotor and the stator of the electric motor, at least one lining is to be arranged at the front-facing side of the annular gap, which for its part, is designed to seal, at least at high rate of rotation by the rotor, without touching.

[012] According to an advantageous design of the invention, the lining is fashioned in such way and arranged on the rotor so that at a standstill or at a low rate of rotation it seals the annular gap by being in contact and that at a high rate of rotation, it is released from the annular gap.

[013] Furthermore, it is recommended, in the sense of the invention, that the lining be formed through a more or less familiar V-ring.

[014] Additionally, it is foreseen that the annular gap, preferably at the location of the lining that is on the opposite side of the electric machine, be linked to an air intake opening.

[015] Finally, it is recommended that the air intake opening be connected through a vent pipe with the interior of the motor vehicle drive mechanism that is linked to the vehicle transmission.

[016] SUMMARY OF THE INVENTION

[017] According to the invention, the seal of the electric motor that is attached within a motor vehicle drive mechanism to a radial of the wet running gearshift element placed within the free construction space of the electric motor rotor gear as, for example, a multiple disk clutch or a multi-disk brake which provides, first of all, in view of the state of the art of technology, for a significant advantage in that the penetrating oil will already be carried away from it into the annular gap. Furthermore, this seal is simple to engineer and is judged to cause especially little abrasion. By using the measures according to the invention, the electric motor will remain functional for a longer period of time so that it can remain at a standstill for longer periods of time. In addition, the working life of the oil is increased, since in a hot annual gap, the oil will be damaged.

[018] Moreover, because of the low rate of abrasion, the use of a V-ring would have hardly any negative affect on the electric motor torque. The special construction of the V-ring has the effect that with a minimum of loss in performance it falls back even more with the increasing rate of rotation. Also, such a V-ring at a standstill can effectively prevent penetration of oil into the annular gap.

[019] BRIEF DESCRIPTION OF THE DRAWING

[020] ~~Subsequently, t~~ The invention will ~~be explained in greater detail on the basis of a design example represented in a drawing. The only figure~~ now be described, by way of example, with reference to the accompanying drawing in which:

[021] The sole Figure shows a schematic of a partial lengthwise section of an electric motor arranged within a motor vehicle drive mechanism.

[022] DETAILED DESCRIPTION OF THE INVENTION

[023] There follows the well-known electric motor arrangement, which can be used as either a drive motor or as a generator, and which consists of a stator 1 and a turning rotor 2 placed in it with an annular gap 3 pictured between them.

[024] Arranged within a free construction space 4 of the rotor 2 is a gear clutch in the form of a wet-running or, as the case may be, an oil-cooled multiple clutch disk 5, which is connected to a function-linked motor vehicle drive mechanism 6. In place of a multiple disk clutch, a multiple disk brake can also be used.

[025] During the operation of the multiple disk clutch 5, oil will be needed to cool it which, as explained above, flows from a crankcase sump (not represented here), and is taken up by disks 7 of the multiple disk clutch 5 and, because of the centrifugal force, flows out again in the same radial path. Subsequently, the cooling fluid flows through a cooling oil drain 8 in a large diameter back into the crankcase sump.

[026] During the earlier explained oil cooling, unintentional oil penetration can occur into the annular gap 3, which may be damaging to the function and the life span of the electric motor.

[027] In order to counter this problem, that is to say, to largely prevent oil penetration into the annual gap 3 during the operation of the electric motor or to push it out as fast as possible, the invention provides at the front-facing side of the annular gap 3 for at least one lining 9 which, for its part, at least at a high rate of revolution by the rotor 2, depending on the type of the gap seal, has been designed to seal without touching.

[028] In terms of its function, the gap seal is such that, as soon as the electric machine or, as the case may be, its rotor 2 is turning, the oil located in the annular gap 3 moves out of the annular gap 3 as a result of the effect of centrifugal forces. Further, the turning of the rotor 2 generates an air stream which also prevents the penetration of oil from the outside into the annular seal 3.

[029] In order to advantageously support the removal of oil from the annular gap 3, according to a preferred design of this invention, an air intake opening 10 is indicated, which can be included at the front-facing side of the electric machine located opposite the lining 9, from where a further reinforced air flow within the annular gap 3 drives out the oil, and also in the area of the lining 9 (the gap lining) prevents the penetration of the oil from the outside into the annular gap 3 as soon as low rates of rotation of the rotor 2 occur.

[030] It has been proved to be advantageous to link the air intake opening 10 through a vent pipe with the drive interior of a motor vehicle drive mechanism-connected vehicle transmission.

[031] Additionally, under certain circumstances, oil penetration into the annular gap 3 can also occur in the case of an electric motor being at a standstill or, as the case may be, at the stopped multiple disk clutch 5 and the corresponding skewed transmission position.

[032] In order to counter such a nuisance, the lining 9 is advantageously designed and placed on the rotor 2 so that it will seal the annular gap 3 even at a standstill or at a low rate of rotation while touching, and at a high rate of rotation will release the annular gap 3 so that a maximally effective the gap seal can be developed.

[033] The already-known V-ring has proven itself as especially suitable for the design of a lining 9 such as that described, and its advantages have been described in greater detail above.

Reference numerals

1	stator
2	rotor
3	annular gap
4	construction space
5	multiple disk clutch
6	motor vehicle drive mechanism
7	disks
8	cooling oil drainage
9	lining
10	air intake opening